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Operational Context Training in Individual Technical Skills

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HumRRO

HUMAN RESOURCES RESEARCH ORGANIZATION

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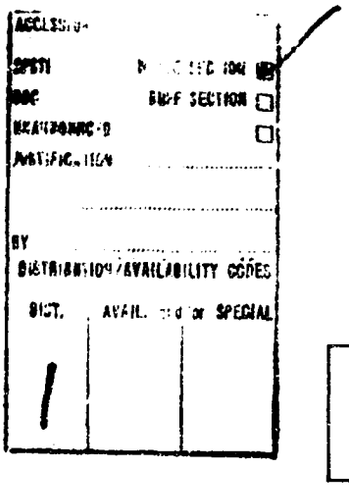

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Prefatory Note

The papers published herein were given at a conference dealing with the objectives and problems of operational context training, sponsored by HumRRO in June 1958 in Washington. Attendees included representatives of training agencies of the Department of the Army and the U.S. Continental Army Command and HumRRO training specialists.

Dr. Hoehn's paper was based on research conducted under HumRRO Work Unit JOBTRAIN, Development of a Method for Building Training Programs for Signal Corps Electronics Repairmen. Dr. Woolman's paper was based on Work Unit LOCK-ON, Training of Guided Missile Operator Personnel.

Because of the continuing relevance of the subject matter of these papers, they are being issued as part of the HumRRO Professional Paper series. This series was initiated in order to provide permanent record of specialized aspects of HumRRO work, and deposit in the scientific and technical information storage and retrieval systems of the Department of Defense and the Federal Clearinghouse.

CONTENTS

ORIENTATION OF THE CONFERENCE

William A. McClelland

The morning session of this conference will be devoted to the presentation of three papers dealing with the meaning and potential of operational context training by Dr. Hoehn, with operational context training for Nike operators, by Dr. Woolman, and with training in the operational context by Dr. Glaser. In the afternoon session we will discuss the five specific topics listed on the sheets that have been distributed.[1] We hope to obtain audience opinions and observations, as well as definitive guidance as to the direction the research effort should take. This is an informal session; policy decisions will have to be obtained later through more formal channels.

The HumRRO conference objectives are twofold: (a) To assess the current status and explore the potentialities of on-site or operational context training; (b) to generate guidance for research to support effective use of on-site or operational context training. HumRRO's position is fairly clear-cut. If, as we believe, a training problem does exist in this area, it is an appropriate problem for us, for our mission is training research. Our general research goals are to aid the Army in making the best possible use of the manpower pool with specific regard to training activities. Specific goals would be:

(a) To increase proficiency through improved training. This might involve increased cost. Usually, in these days of budget-consciousness, however, we are interested in increasing military proficiency at reduced cost.

(b) To reduce training costs with no loss in proficiency. If we can demonstrate appreciable savings in training time, in dollars, or in the need for highly experienced instructors, then this, too, is a legitimate goal of our research activity.

[1] An informal transcription of part of the questions, answers, and discussion is contained in an Appendix to this publication.

OPERATIONAL CONTEXT TRAINING: ITS MEANING AND POTENTIAL

Arthur J. Hoehn

Operational Context Training, as it can be used to increase job performance of military skills through the development of training materials and techniques specifically designed to fit the characteristics of the operational setting, is explained in this paper. The emphasis is on developing individual, technical skills, and the operational context training is differentiated from on-the-job training.

INTRODUCTION

It is important to have some understanding of the meaning of the term "Operational Context Training" in the sense it is used in this paper. It is training conducted in the operational situation to increase performance capabilities in required military skills, and by means of careful mobilization and application of all of the resources available for training in the operational unit. Three elements are:

(1) Operational context training (OCT) is *conducted in the operational situation.* (This, of course, is directly implied in the term itself.)

(2) Operational context training has the *objective of increasing performance capabilities in connection with required military skills.* In this respect, it is no different from other Army training. Presumably, all military training is directed to this goal.

(3) Operational context training is *implemented through mobilization and efficient application of all the resources available for training in the operational unit.* The responsibility for such training is assumed by the operational unit as a recognized part of its mission; and this responsibility is viewed as belonging to the whole operational unit rather than being the responsibility of the individual technician or work supervisor.

It is in this third element of the definition that operational context training can be differentiated from on-the-job training. In general, the latter refers to informal training activity[1] wherein the

[1] [Ed. Note: OJT is now a formal program, defined by CONARC Reg 350-1, Annex W, as a program by which a soldier receives training in a unit which leads to the award of an MOS. This method is used when USATC and Army schools are unable to accommodate available input of students for formal training.]

responsibility is that of the individual soldier assisted to some degree by a "buddy" with a somewhat longer period of experience. In general, on-the-job training in this pattern has not been highly successful. Operational context training would involve a different pattern—one in which the individual trainees and work supervisors are part of a larger organizational effort with continuous and substantial support from the larger organization. Operational context training may be viewed as a special type of on-the-job training—on-the-job training with a new approach.

The differentiation between on-the-job training and operational context training will be fully clarified in the paper in this series by Dr. Woolman, describing an operational context training program in action.

From a conceptual standpoint, the term "Operational Context Training" implies no restriction in terms of the kinds of performance capabilities being developed. The skills sought through such training can be technical, administrative, leadership, or combat skills. They can be individual skills or unit or team proficiency. However, in this paper we will focus primarily on operational context training where the performance objectives are *individual, technical* skills. The nature of this restriction is portrayed in Figure 1. The total space of this diagram represents all the kinds of performance capabilities required by the Army. They are subdivided in two ways: First, a distinction is made between technical skills and other skills such as those involved in administration, leadership, and certain combat activities. Second, each of these two broad categories is subdivided into individual skills

Possible Performance Objectives of Operational Context Training

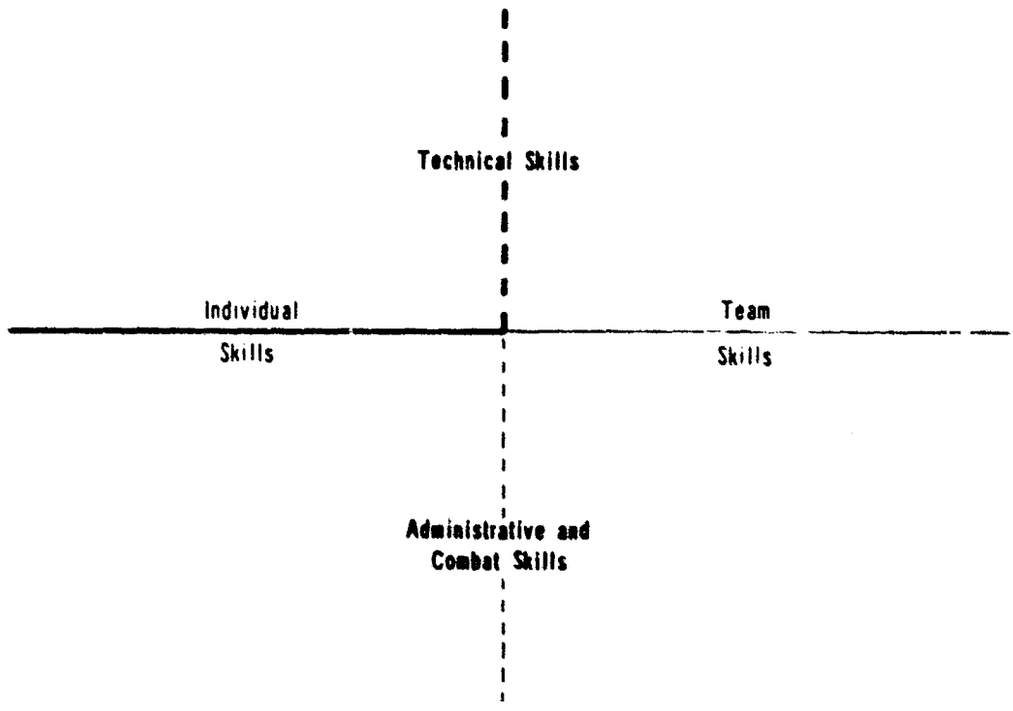

Figure 1

and team skills. Of the possible performance outcomes that could be developed through operational context training, our attention will be directed largely to those that are individual and technical; that is, the skills represented by the upper left segment of the figure.

THE OPERATIONAL CONTEXT: ITS PROBLEMS AND OPPORTUNITIES

We are all aware that the operational context is substantially different from the school context. The basic differences in these two kinds of situations appear to be:

School Context	Operational Context
Training as the sole mission.	Training as a complementary or competing mission.
Separated from job operations.	Integrated with job operations.
Large number of men at similar stage of training.	Small number of men at a given stage of training at any one site.

These fundamental differences in context result in differences in training resources. The effect is that both school training and OCT have their peculiar advantages and problems. Some of the potential advantages of operational context training are:

(1) Improved manpower utilization—men can do useful work while in training status.
(2) Permits realistic practice on up-to-date equipment.
(3) Trains men in job capabilities, not school capabilities.
(4) Permits use of highly skilled specialists as instructor personnel.

At the same time, the organization and conduct of an effective training program requires that we deal with problems not found in the school context:

(1) Lack of personnel trained as instructors and training supervisors.
(2) Lack of special training facilities and special training equipment.
(3) Conflict between training and operational missions.
(4) Lack of training materials and procedures suited to the context.

The resources and problems more or less unique to school training and to operational training strongly indicate that schools should develop some of the components of job capability, and that operational context training should develop other components of job capability.

OPERATIONAL CONTEXT TRAINING IN DEVELOPMENT OF JOB CAPABILITIES

As implied above, OCT may be viewed as one of the possible sources of skill requirements. The other major sources are (a) school training

and (b) performance capabilities that the available men already have. Consider the problem of filling the need for a large number of men who can perform all the job duties in a particular MOS. This can be accomplished only by tapping the three sources of job capability. And, of course, we want to draw on these sources so that required skills are developed with maximum overall economy.

There is no general system or process by means of which this can be done, but an outline of one approach is shown in the first column of Figure 2.

An Approach to the Process of Developing Operational Context Training

Outline of an Integrated Development System	Problems of the System	Guidance Documents Needed for OCT
Define Performance Requirements	1. How should the using organization define its requirements?	1. Instructions for defining performance requirements.
Analyze Job Tasks Into Smaller Segments	2. How should the job-task analysis be done?	2. Instructions for analysis of duties.
Allocate Performance Segments to Sources	3. How should decisions on sources be made to ensure overall economy?	3. Instructions for deciding which performance segments to a. Develop in schools. b. Develop Through Operational Context Training.
Already in Specialists Repertoire / School Training / Operational Context Training		
Design of Methods & Materials / Design of Methods & Materials	4. How should the methods and materials be designed?	4. Instructions for designing methods and materials.
Evaluation	5. How can we assess a. Progress of individuals? b. Success of each type of training. c. Effectiveness of the system?	5. Instructions on how to assess a. Individual trainees. b. Success of each type of training. c. Effectiveness of the system.
Use		

Figure 2

First of all, we need to state the performance requirements of the job. Specifically, this statement should include:

(1) A list of the job tasks that the men assigned to the MOS must be able to perform, and
(2) A definition of what is to be considered adequate performance of each job task.

This statement of performance requirements is simply a statement of objectives. It does not tell how to reach the objectives, that is, it does not tell how to get the performance capabilities.

A first step in deciding how to get the performance we want is to make a job-task analysis. This will yield detailed descriptions of the specific steps and processes involved in each job task. Ideally, these specific steps and processes should be described and categorized in terms that have implications for decisions in selecting training conditions and designing training techniques and materials.

On the basis of the job-task or duty analysis together with information on the training resources available in schools and in the job context, decisions must now be made as to *which job tasks* or segments of job tasks are to be taught to *what level of proficiency* in school and what should remain to be taken care of in the operational situation. This should involve an integrated joint planning effort by those responsible for school training and those responsible for training in the job setting. Without careful integrated planning, we can expect:

(1) An inefficient distribution of training activity between the school and the job situation.
(2) Lack of clear understanding as to who is responsible for what training (this will mean men will be overtrained on some job duties, not trained at all on others).

At this point, it may be decided that all the training necessary to produce men completely qualified to do the whole job should be done in the school, *or* that all the training should be done on the job. However, it is likely that in many instances the decision will be to divide the responsibility, taking into account the peculiar advantages and resources of each type of training context.

The next step is the design of training methods and materials. There are several points that seem relevant:

First, if the training responsibility is to be shared between school and operational unit, the development of techniques and materials should also be done in an integrated manner, not only to insure coordinated coverage, but also consistency in approach (examples: nomenclature, job processes like troubleshooting).

Second, although the techniques and materials prepared for use in the field must be *consistent* in content, goals, and general approach, they cannot be identical with those used in school. Attempts to use the same materials and methods as are used in the school are almost certainly doomed to failure. This is due to the fact that school methods and materials are designed to take advantage of the resources peculiar to the school situation: for example, a highly trained instructional and supervisory staff, high-cost training equipment, facilities designed for mass training, and the availability of large blocks of training time that can be scheduled without major concern for extensive and unexpected interruptions to meet immediate operational demands.

Third, the problems of designing materials and methods appropriate to the field are no less difficult and require no less effort

for solution than the design of materials and methods to be used in the schools. Yet it would appear that we use substantial sums of money to plan school programs and materials and assign large numbers of experts to the process, while expecting operational personnel who are burdened with other duties and who are unfamiliar with efficient training proce ses, to devise the programs and materials to be used in the operational context.

Fourth, progress in achieving the most economical distribution of training responsibility as between the schools and the operational situation depends more than any other one thing on the development of training materials and techniques that are carefully tailored to characteristics of the operational setting and the training resources available there.

Let us return to the subject of the general development system. Once the content has been determined and the methods and materials designed, it might be supposed that we are immediately ready to put the system into general operation. This, of course, is not the case. Before this is done, it is desirable that there be a tryout of the system on a relatively small scale. That is, the development system needs to be tested on an experimental basis. Such a test has several purposes:

(1) To determine the extent to which the school and operational context training are meeting their respective responsibilities.
(2) To determine the effectiveness of the total system for turning out men who are fully qualified in terms of the performance requirements.
(3) To identify weaknesses in the system that need correction before the system is applied on a larger scale.

This outline of a system for developing fully capable men has been presented to delineate these requirements for an effective operational context training program:

(1) The need to gear all such training to specifically defined skill or performance requirements.
(2) Where training responsibility is to be shared with the school, the need for integrated planning to define the proper division of responsibility and to insure continuity and comprehensiveness in the techniques and materials to be used.
(3) The need for OCT methods and materials that are expertly designed to fit the characteristics of the tasks to be learned and the characteristics of the job context.
(4) The need to *evaluate* OCT as part of a larger system for producing job capabilities.

THE ROLE OF RESEARCH IN FACILITATING DEVELOPMENT OF OCT PROGRAMS

Let us turn to the question of how research can contribute to the development of operational context training programs that meet these

requirements. Statements on this matter are based on what is perhaps a bold assumption that there is room for improvement in current practices.

First, I note a lack of existing techniques for the systematic collection of information as to what is going on in the way of training in the field situation. A great deal of the total training in the Army is being left to the operational situation, but, so far as I can find, there is only limited information with respect to the techniques being employed, the resources being utilized, and the management practices being followed. Systematic survey devices and techniques could be devised that would provide this kind of information. In addition, they could yield data required in planning new and improved OCT programs—particularly data on personnel and material resources that could be made available in training activity, and information as to any special problems that would have to be met to establish a successful program.

Although the development and use of such survey devices and techniques would, I believe, prove useful, they would not in themselves result in better OCT. Thus research and development activity certainly should not stop at this point. Perhaps the greatest contribution R&D work could make in the area of OCT is the development of prototype operational context training programs. Essentially, this would involve the development of one or more actual programs that could be used as models in the planning and conduct of still other programs to teach similar skills in other similar contexts. In addition to yielding a model for further development work, this approach has two other payoff values: experimental test of the model program constitutes an evaluation of the principles that governed the construction of the model; and, moreover, the model program itself will have immediate operational applicability.

Incidentally, this approach to the development of a prototype program is demonstrated in the work of Dr. Woolman, which will be described in the next paper.

Since we already have one excellent model program in being, it is only natural to ask: Why do we need additional models of this sort? Why is it that the existing prototype is not necessarily sufficient to guide development of all other OCT programs that may be needed? The answer is, I believe, very simple. One model OCT program is not likely to meet *all* requirements for the same reason that one model of automotive vehicle is not entirely appropriate for all uses under all road conditions. Any one model is necessarily developed to meet the requirements and characteristics of one type of context; additional models are needed as we consider quite different contexts. Also, configuration of any one model program will be adapted to the particular types of job capabilities that the program is to produce. Thus the methods used in training men to perform lengthy procedural tasks (such as inspections, assembly tasks, and equipment checkouts) may not be appropriate in all respects for training men in decision-making tasks such as trouble-shooting. Finally, a somewhat different set of problems will be met in instances where, in connection with a particular MOS, we divide up the responsibility between school and the operational situation than where all training is to be given in the job setting. In short, we

need additional prototype models because no one model can cover all types of jobs, all types of operational training contexts, and all types of divisions of responsibility as between the school and the operational organizations.

In the development of any prototype training program, it is necessary to make a great many decisions and to devise a great many methods. Properly recorded and organized, the concepts that have guided the development process and the procedures by which they were applied can also constitute a highly useful product. The difference between the prototype model and these "how to do it statements" is the difference between a product and having instructions on how to make the product. Thus, you might be able to assemble a chair simply by referring to an already assembled chair. However, the job might go more smoothly if, in addition, you had a set of instructions giving a step-by-step description of the assembly process. It thus seems desirable that work in the area of operational context training should not only produce one or more model programs, but that efforts should also be made toward the preparation of "how to do it" statements.

What might these "how to do it" instructions cover in connection with the development of operational context training programs? They could cover various aspects of problems that arise in connection with application of the integrated development system described earlier. (The problem areas and the needed guidance documents are shown in the last two columns of Figure 2.)

While we cannot hope for final statements of this sort to cover all possible situations, it should be feasible to prepare tentative guidance documents for one type of job position (such as equipment repairman jobs) that could be improved through time. The improvements in the guidance documents would derive from these sources:

(1) New knowledge about effective training methods that might come from laboratory studies or field studies.
(2) Experience in developing model programs for new types of jobs and job contexts.
(3) Feedback from the field as to weak points that have been shaped in accordance with the initial guidance documents.

Any set of "how to do it" instructions will necessarily be tentative; they should be viewed as something that can grow and improve through time, being revised to eliminate error and to incorporate new knowledge.

As mentioned earlier, it is my belief that progress in achieving the most economical distribution of training responsibility as between the schools and the operational situation will depend more than any other one thing on the development of training materials and techniques specifically designed to fit the characteristics of the operational setting. If this is true, it may be desirable that some research effort be directly focused on the design of such materials and methods. This might include studies of methods of communicating technical information in the job situation, the design of self-teaching materials, the design and use of low-cost training devices suited for individual or small-group use, and development of diagnostic and performance tests for routine use in operational units.

OPERATIONAL CONTEXT TRAINING FOR NIKE OPERATORS

Myron Woolman

The operational context training research rationale and an illustration of its application are described. The illustration involves developing and testing a method of training inexperienced Nike integrated fire control operators on-site. The Training Guide that resulted included (a) a breakdown of operator procedures, (b) specific instructional techniques, and (c) a method of evaluating trainees.

Operational context training is concerned with increasing the efficiency of the operational situation as a vehicle for producing skills and understanding. Work Unit LOCK-ON represents an illustration of the use of the method; the following is a description of the research.

Most men assigned to a Nike site lack prior training in Nike operator duties and must necessarily be trained under field conditions. In Work Unit LOCK-ON the concern was with developing a method suited to the operational situation. The research was based on these four principles:

(1) Training in the operational situation must be subordinate to the operational mission.

(2) The total resources available for training in the operational organization (skills, manpower, equipment, buildings, administration, and time) must be integrated into a training program compatible with operational needs.

(3) Training materials, methods, evaluation, motivational devices, and quality control techniques supplied through research must be integrated and adapted to conditions in the field.

(4) OCT training involves the training organization as a whole and must be flexible enough to adapt to organizational requirements, but systematic and continuous enough to produce required skills efficiently.

An operational unit in the field possesses skilled personnel, equipment, and an administrative structure. These resources are basic to the establishment of any training program. Operational context training is concerned with utilizing the totality of training resources in the field, supplementing where necessary with special materials and techniques, and emerging with a rounded, efficient training program directed at increasing the quantity and quality of operational skills. It is aimed at making the operational unit as self-sufficient as possible in producing the skills required for performance of its mission. Ideally,

it should offer minimal interference with the demands of the operational situation, while supporting and strengthening the capability of the organization for performing the mission.

The operational situation will normally lack trained instructors, organized training materials, evaluation methods and long-range planning facilities. These required ingredients for an effective training program must be supplied and adapted flexibly to the needs of the operational situation. An adequate operational context training program provides methods for producing the needed skills efficiently and economically, the additional ingredients supplied to the ongoing operational situation in such a manner that the training adds to, rather than reduces, operational effectiveness.

The operational context training program for use at a Nike site was ultimately put into the form of a text entitled, "USARADCOM Integrated Fire Control Training Guide."[1] This guide for the United States Army Air Defense Command (USARADCOM) was concerned with providing the following training benefits for the operational Nike battery:

(1) Provide complete coverage of all integrated fire control (IFC) operator procedures.

(2) Material presented in simple, nontechnical language and related to operator duties rather than to system electronics.

(3) Flexible enough to meet a constantly changing battery situation.

(4) Provide an effective and simple instructional technique suitable for use by personnel lacking instructional experience.

(5) Provide evaluation and quality control over operator proficiency.

(6) Provide opportunity for each trainee to reach the limits of his capabilities.

(7) Provide opportunity for each trainee to move through program at his individual rate of speed.

(8) Provide meaningful incentives for learning procedures.

(9) Retain planning and control in hands of officer personnel with minimal expenditure of time while substantially increasing training activity at the enlisted level.

The information in the Training Guide was subjected to a series of screenings to provide accuracy and sound operational practice. These screenings consisted of:

(1) A tryout on equipment in on-site situation.

(2) A four-day, step-by-step review by Western Electric Company and Second Regional G-3 personnel in conference at Fort Meade, Maryland, with emphasis on engineering and tolerances.

(3) A four-day, step-by-step review by qualified personnel at Fort Bliss, Texas (Antiaircraft and Guided Missile School, First Guided Missile Brigade, 495th Battalion and Board #4) with emphasis on operational suitability of procedures.

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[1]HumRRO Research By-Product, July 1957.

(4) Coordination during production of Field Manual 44-80 C-1 to insure procedural similarity.

(5) A step-by-step run-through of all procedures to insure accuracy of designations and support information (six days).

(6) A briefing of USARADCOM General Staff and review by G-3 prior to publication.

A survey was made in May 1957 covering all batteries within continental United States to obtain background information and estimates of battery operator proficiency. Using sampling procedures, 24 batteries were selected for experimental evaluation of the on-site training program.

Twelve batteries involved in the field study used the USARADCOM IFC Training Guide. The field evaluation extended from August to mid-December 1957. Beginning in late October each of the 24 batteries was evaluated during an entire duty day. Nike IFC operators were given: (a) a performance test of 23 representative procedures; (b) an operational type of written test covering 30 representative procedures; (c) ratings of operator performance by technically qualified personnel. In addition, officers familiar with the experimental training program (Battery Commanders, Battalion, and Group S-3 officers) completed a form evaluating the effectiveness of the USARADCOM IFC Training Guide.

Performance test (reliability .91), written test (reliability .95), and ratings by technicians (reliability .74) provided support for the effectiveness of the experimental training program. On the three measures, operators trained in the experimental program were significantly superior to operators in the Control batteries matched with them for battery experience and intelligence. The evaluations by officers familiar with the program strongly supported its adoption.

Formal school training is of relatively short duration and involves considerable cost. Military personnel spend most of their time in the field situation. Training methods, adapted for use in the field, are efficient in producing operational skills and can play a substantial role in increasing the skilled manpower reservoir available for use. Operational Context Training is aimed at using the time, manpower, and equipment resources present in the field situation. Its goals is to support the operational mission while assisting the command in producing operational skills. At this time, OCT appears to be adaptable to a wide variety of training areas. There is a need for intensive research to develop OCT methods suited to varying job requirements and the differences in operational situations. Work Unit JOBTRAIN is directed toward exploring these dimensions. The LOCK-ON study represents an initial effort concerned with the development of Nike Operator skills. The results appear to justify the belief that proper research directed toward improving the learning yield of OCT research can produce improved manpower utilization and higher skill levels in the operational situation.

TRAINING IN AN OPERATIONAL CONTEXT

Robert Glaser[1]

Operational context training is discussed in terms of the human component. The readiness of "Component H" and logistics and costs of OCT are discussed. A program for training is outlined and the four objectives for it delineated and examined.

Readiness

A reliable quick response system is built up from reliable components that are kept in a finely-tuned ready state. A component is most likely to be in this condition if it undergoes these appropriate procedures:

Servicing
Periodic Checking
Necessary troubleshooting and repair
Improvement and modification as required

Most military systems have a component, H, the human component, which requires these procedures. Like other components, the human component will deteriorate without them. There are technical component officers who know all about electronic circuits; perhaps we also need people who are experts in Component H (the human factor) and are concerned with its care and maintenance. We need technical manuals for Component H; perhaps operational context training manuals take on the status of technical maintenance manuals for the human component in the system.

The appropriate initial characteristics are built into Component H through formal training. Following this, the above procedures are pertinent. With the possible exception of "Servicing" which for Component H involves the establishment of an environment contributing to good health and high morale, a program of training in the operational context involves the following procedures:

(1) Periodic checking is accomplished by means of carefully developed proficiency tests or "readiness checks."

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[1]Ed. Note: At the time this paper was given, Dr. Glaser was Associate Professor of Psychology, University of Pittsburgh, and Technical Consultant to HumRRO and the American Institute of Research; he is now Professor of Education and Psychology, Learning R&D Center, University of Pittsburgh.

(2) Troubleshooting is accomplished by an analysis of the results of the proficiency tests, by determination of causes of failure, and by the institution of appropriate training or job redesign.

(3) One of the most effective built-in circuits of Component H, given the proper inputs, is its capacity for improvement and modification. This means that we can, by appropriate training, build into Component H a number of basic knowledges and skills. He, Component H, can then proceed to operate and to actually perform useful operations while at the same time being modified in order to perform more complex operations. Operational context training contributes to this component modification with minimal component down time.

This brings to mind an important criterion of effective training in the military context: Training should be conducted so as to result in the longest amount of service time while permitting a man to reach his highest level of skill as quickly and effectively as possible. It seems that a well-considered combination of formal training and Operational Context Training (OCT) can accomplish this.

There is a further general point I like to call "Rorschach's Law." This is the statement that "the less we can specify the specific behaviors involved in a job the greater the requirement for formal training." (It has at times seemed to me that good opportunities for OCT in such areas as equipment troubleshooting and perhaps officer tactical training are lost because the behavior involved has not been investigated in detail by appropriate job task analysis.) The assumption is made here that formal training in theory and general principles enables individuals to learn with long exposure to job situations. While this may take place, it is a slow process that may incorporate the learning and unlearning of error.

Further issues involved are questions of concern to HumRRO scientists. How much theory is necessary to do the job? To what extent does extraneous theory cause failure in training and inhibit the learning of relatively simple tasks? How much can be made procedural and "cookbookish"? To me it is a good sign, not often pointed out in these days of job simplification, that maintenance personnel sometimes complain about cookbook procedures, "We lose the fun of working out the problem." My answer is that to let us—by job analysis, job design, appropriate training, and job aids—simplify what we can. We will still manage to find challenging problems. Relevant here is the point that to the extent which a job can, by careful job analysis, be cast in standing operating procedure terms, it becomes a candidate for an increasing amount of OCT employing the procedures indicated by Dr. Woolman. These training packages can be prepared with detailed instructions for field use and can be used with appropriate monitoring by a training (or Component H) officer.

Logistics and Cost

A factor related to money arises in selecting MOSs for the development of operational context training packages. When a weapon is developed, there is a great hurry to get it into the field. Often

the school set up for formal training on a particular weapon has to work with inadequate discarded spare parts, mockups, and the like, because a training weapon system is too costly and has been cut out of the budget. In this type of situation, if formal training suffers, then OCT packages should be developed, since they are a practical necessity for effective training.

A Nike site might have attached to it a target training simulator that would be only a small amount of the total equipment cost. Trainees now track slow-moving airplanes as targets that do not give them much practice for the kinds of weapons they would track realistically. They need realistic training situations—a realistic training simulator in a system will keep Component H on his toes. If we neglect him, the whole system can't work.

The training process in most contexts consists of four primary objectives that must be accomplished in developing operational context training:

(1) Specification of Training Objectives—a careful analysis of what has to be trained for.

(2) Input Control—appraisal and selection of men who will be put into the training situation (This is the role of Personnel Research Branch—The Adjutant General's Office).

(3) Training Procedures.

(4) Output Control—quality control of the product (Component H) coming off the training production line.

Specification of Training Objectives

The first step in setting up an OCT program is to state the objectives of the program. By this we mean that the behaviors to be learned as a result of training should be specified in terms of the particular actions and operations that men must perform. This is done by job and task analysis procedures, part of the technical know-how of HumRRO scientists to assess the skills and knowledges involved. Where we cannot specify what is involved, we have to guess. It is not enough to state that the objective of a training program is to produce a good officer or supervisor, a proficient technician, or a loyal soldier. The particular skills and attitudes that make up these job performances need to be specifically analyzed and set down as training objectives. Training is a matter of shaping up what we want.

There are lots of problems that come up in defining a job, in a particular organizational structure. How can the job be reorganized or combined with other jobs so that it can be taught most effectively? To what extent is the man being trained for the immediate job or trained so that he can convert to other jobs? There is always a problem for the military in training logistics, for example, amount of equipment, and number of men being trained. Are we going to train a man with certain basic principles so we can provide the basis for

learning for a particular job, or are we going to train him with certain general knowledges to permit him to further learn things for mobilization? Is it an immediate need or a need for the future? Each requires a different thing. We usually compromise. Operational Context Training can get the man working on specific things and then provide general training.

We should carefully study *training overlap*. Many training programs are going on in the military at the same time. Many components in certain systems are very much like components of other systems. Careful studies of previous training and OCT are necessary so that we can incorporate into a new MOS what we know from other MOSs.

In analyzing it, we should not accept a job as a fixed thing. Often it may be much more practical to reorganize or *redefine the job* so that we can give more efficient training. Perhaps we can use lower aptitude people. We should go into a job analysis not only to accomplish it for the job as fixed, but also to make recommendations about redefining the job.

Input Control

The input control problem is adequately taken care of by selection tests by the Personnel Research Board. For OCT we especially need tests that assess and diagnose training needs and causes of departures from proficiency. This gives you an estimate of what people know, what kinds of errors they are making, and so forth. What we really need is the best possible combination of tests and training methods. Sometimes we are forced to redesign a job because we are forced to take another kind of input.

Training Procedures

I would like to point out that training is a technical business. HumRRO scientists have to worry about several things in building a training package. Let me mention some of these. They know that learning is facilitated when behavior is controlled through careful guidance of the correct response, that is, any procedure that ensures that a trainee performs a task in a way determined correct by the trainer. They try to set up a system whereby the correct responses of the learner are carefully controlled so that he makes a minimum of errors and has the right amount of practice. If we permit him to make too many errors, he will be slowed down; we have to reinforce him to help him build up to a successful level of performance. We often use learning supports at the beginning of a job. In developing these OCT packages, HumRRO training experts may in the beginning provide learning supports, and in the end, for realistic proficiency pull these supports away. By a gradual process these supports are withdrawn and the learner shifts over to other behavior—this requires technical know-how of the learning behavior process.

The reward that follows from the performance of a task is called reinforcement, for example, feedback about how well a job is being

done, some sort of favorable mention, approval, or praise. The OCT packages we are concerned with specify that efforts should be reinforced in order to facilitate learning in OCT situations.

Some ways of learning are better than others. The major problem in training is arranging successive tasks in such a way that a behavior is efficiently learned. The implication of learning research in the military has been that a systematic method of practice teaches a man much more than a highly natural situation. In a simulated natural situation he may not learn as readily or as well as would be the case if an appropriate learning sequence were set up in the beginning.

Another problem for OCT is the identification of the theory to be taught. We know that learning is facilitated when learning tasks are connected by some meaningful relationships. It follows that wherever possible we ought to teach a man some relationships that are meaningful to his job. It is important to discover those principles and realistically relate those principles which apply to the job and those which do not. Often the principles that are taught in formal training are principles which relate the job for the design engineer but do not relate the job for the operator and repairman on a lower level. The principles required for a repairman are somewhat different from design engineer principles. In formal training people who teach theory courses often teach high school or college elementary electronic theory. This loses a lot of men. At one level we can teach only appropriate theory to do the job and then as a man's Army career advances he can learn advanced skills which relate to the job at a higher level.

Athletic coaches concerned with "shaping up" manipulable behavior have a training situation that permits them to see what they are doing and thus really shape the behavior in a desirable way. In a formal lecture method we have no real control over how the men are learning. These packages set up in OCT have the advantage of making overt the behavior that must become skilled. Much of the work that HumRRO has done is to build troubleshooting tests that force a man to show what he does in troubleshooting so they have behavior they can shape. If it is just in his head, they have no specific response to work on.

A problem that can reduce the effectiveness of OCT concerns motivation and motivating conditions. To the extent that any of these learning procedures will work, it is going to be a function of the motivating conditions that will either enhance or depress their effectiveness on the job. These training packages are often motivating of themselves. They (the trainees) can actually see what they are doing and can enjoy working on it in many cases. Perhaps the introduction of a Component H officer would keep these motivating conditions high.

Output Control

As far as output control is concerned, the people who build tests often suffer from the fact that traditionally tests are graded on the curve—they give a group of men a test and say this man did the best,

he gets the top grade, and then the lowest man gets zero. This should not happen in training. An absolute standard must be set for the job, and the man must attain it.

Another advantage of OCT is that some team training can be incorporated. Team training is important since the job feedback to a man is complicated because it passes through several people to produce the end result—this team training could take place in OCT.

In general, the setting up of a training program of this kind has features that should undergo experimental study. Psychologists and training experts can bring to it experience based on research findings. Close cooperation between training personnel and training psychologists is producing a set of practical hypotheses that can be built into formal training programs. This endeavor we hope will result in a highly reliable Component H in the overall system.

APPENDIX[1]

STATEMENT OF FIVE IMMEDIATE ISSUES TO BE CONSIDERED IN RESEARCH ON OPERATIONAL CONTEXT TRAINING

Issue #1—Selection of a Major Training Objective

Research on Operational Context Training (OCT) could be directed toward any one of several possible major training objectives. Although work on any one of these objectives will no doubt have inputs for other objectives, still the research products and methods will differ to a considerable degree as a function of the type of training objective selected.

Some of the major types of objectives that could be pursued are:

(1) Improve OCT as a means of increasing the rate at which recent school graduates achieve a satisfactory level of job competence.
(2) Substitute OCT for some segments of advanced individual technical training courses now given in formal school courses.
(3) Reduce required formal school training through integrated planning of school training and OCT.

The problem is this: Toward which of these, or other major training objectives not mentioned, should the research and development activity be primarily directed?

Issue #2—Selection of Required Research Products

What types of research products are needed? Some of the possibilities are listed here:

(1) Survey instruments and data collection and analysis methods that can be used by training officials to determine the status of OCT in any particular MOS.
(2) Reports of the present status of OCT in one or a few MOSs, based on data obtained from application of the instruments and methods developed in Item #1 above.

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[1]The afternoon program of the conference consisted of a discussion of the five issues listed in this Appendix. The outline covers some of the points considered under each topic.

(3) A model program for a specific MOS, designed for the following purposes:
   (a) Serve as a model in the development of other programs for MOSs involving similar job activities.
   (b) Contribute to solution of a training problem currently being experienced in the selected MOS.
(4) Guidance documents providing "how to do it" instructions for developing and evaluating OCT programs.
(5) Research-tested training methods and materials geared to the requirements of the operational setting.

Discuss each item in these terms: Is it a desirable type of product? Is the payoff likely to be worth the required effort? Are there other kinds of research products not included here that should be considered? If so, what?

Issue #3—Deciding What Criteria Should be Applied in Selecting MOSs

In what types of MOSs is the research likely to have the greatest potantial payoff?

Some factors that might be desirable to consider here are:

(1) Presence of an important training problem that might be solved through an OCT program.
(2) Present and future importance of the MOS in Army operations.
(3) Number of personnel in the MOS who will require training.
(4) Resources available for an OCT program.
(5) Geographical distribution of using organizations.
(6) Probable generality of the findings to other MOSs.
(7) Amount of research already being conducted in the MOS.

Issue #4—Selection of One or a Few Specific MOSs

In terms of the criteria discussed in connection with Issue #3, are there specific MOSs that appear to be particularly well-suited to purposes of the research?

No final decision need be made on this issue at this Conference, but any progress that can be made toward such selection would be helpful.

Issue #5—Determination of the Roles of School, Unit Training, and Technical Service Officials, and Research Personnel

It is likely that some phases of the research will require the coordinated effort of technical service officials, school officials, unit training officials, and research personnel This would certainly

be the case if the major training objective were to be reduction in school training.

What problems are likely to derive from experimental reductions in length of school training? How can such problems be avoided or held to a minimum?

What problems may arise as a result of the relation of the planned work to the responsibility of those in charge of unit training programs? How can these problems be avoided?

Is the research activity planned so that it will require establishment of a coordination committee to ensure smooth working relationships of the several organizations likely to be involved? How should such a committee be organized?

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13. ABSTRACT

These three papers were written within the framework of the conference objectives: To assess the current status and explore the potentialities of on-site or operational context training; and, To generate guidance for research to support effective use of on-site or operational context training. The papers are: "Operational Context Training: Its Meaning and Potential," by Arthur J. Hoehn; "Operational Context Training for Nike Operators," by Myron Woolman; and "Training in an Operational Context," by Robert Glaser.

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